Smart Metering
Supporting the Rollout & Success of IoT
Global Smart Meter Overview

Global Smart Meter Size in Billions Units

- Electricity: 1.1 billions
- Gas: 0.5 billions
- Water: 1.4 billions

Global Automated Meter conversion rate in 2017

- WATER
- GAS
- ELECTRICITY

Market Drivers

<table>
<thead>
<tr>
<th>Market Drivers</th>
<th>Electricity</th>
<th>Gas</th>
<th>Water</th>
</tr>
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<tbody>
<tr>
<td>Outage notification</td>
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<tr>
<td>Operational Cost Savings</td>
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<td>AMI* compatible</td>
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<td>✓</td>
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<td>Accurate Billing</td>
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<td>Capacity Management</td>
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<td>Natural resource scarcity</td>
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<tr>
<td>Pipeline safety</td>
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<tr>
<td>Leaks, Revenue losses</td>
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<td>✓</td>
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</table>

* Advanced Metering infrastructure (AMI)

Source: IHS Smart Metering 2017 including China

Global smart metering market poised for continued growth
Littelfuse & Metering: Changing from No-electronic Content to Most Key Functions Based on Dependable Electronics

Littelfuse: Key know-how to help customers implement more reliable & safer smart meters

- Electric transients & overcurrent protection
- Anti-tamper solutions
- Flow measurement devices
- Low power consumption sensors
- Load switching & energy pulse out
- Over-temp detection & temp measurement
- Power management

Littelfuse can help with cross-functional system-level expertise & application testing
Smart Electricity Meter

Anti-tamper:
- Reed Switches and Hall Effect Sensors

Metrology System Unit:
- TMOV/MOV Lightning Surge/Induction
- Cartridge Fuse Overcurrent Protection
- TVS Diode Overvoltage Protection
- SMPS' Opto-isolator Feedback
- SMPS' FET
- NTC Thermistor Temperature Sensing

Communication Interface:
- RF ESD Protection
- Sidactor Wired interface protection
- Opto-isolator Galvanic Insulation

Display:
- RFID Analog Front End

I/O Protection and Control:
- SSR** Load Switching
- Cartridge Fuse Overcurrent Protection
- TVS, SMD MOV Overvoltage Protection
- Fuse or SSR** Overcurrent Protection

* Switched-mode Power Supply
** Solid State Relay
E-metering High Level Block Diagram

1. Metrology System Unit
   - Utility Grid
   - Current Sensor
   - Pre-Regulation
   - Power Supply Unit
   - Voltage Sensor
   - Microcontroller

2. Disconnect/Load Limiting
   - Display
   - Wireless Communication Interface
     - M-Bus, ZigBee, GSM
   - Wired M-Bus pulse out interface

3. Auxiliary Load output
   - Anti-tamper

4. Solid State Relay
   - Reed switch
   - Solid State Relay
   - Fuse or SSR
   - TVS, MOV

5. RFID

<table>
<thead>
<tr>
<th>Technology</th>
<th>Series</th>
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<tbody>
<tr>
<td>MOV</td>
<td>Ultra MOV, CIII, TMOV</td>
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<tr>
<td>Cartridge Fuse</td>
<td>215 &amp; 514 Series</td>
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<tr>
<td>TVS Diode</td>
<td>SMAJ, SMBJ</td>
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<tr>
<td>Opto-Isolator</td>
<td>CPC1303, LIA130</td>
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<tr>
<td>NTC</td>
<td>MELF Style, End-Banded Chip</td>
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<tr>
<td>FET</td>
<td>IXTP3N100P, IXTP4N65X2</td>
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<tr>
<td>ESD</td>
<td>SESD0402x</td>
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<td>Opto-Isolator</td>
<td>CPC130x, CPC590x</td>
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<tr>
<td>Sidactor SEP, SESD</td>
<td>SEPOxx, LC03-3.3</td>
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<td>Solid State Relay</td>
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<td>Hall Effect Sensor</td>
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<td>Reed switch</td>
<td>MDSR-10</td>
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<td>Solid State Relay</td>
<td>PLA192, CPC139x, CPC19xx</td>
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<tr>
<td>Fuse or SSR</td>
<td>Cartridge 216 Series</td>
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<td></td>
<td>CPC15xx</td>
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<tr>
<td>TVS, MOV</td>
<td>SMCJ, SM7</td>
</tr>
<tr>
<td>RFID</td>
<td>NCD1300</td>
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</tbody>
</table>
# Smart Water and Gas Meter

## Battery & Interface Panel:
- SMD PPTC or Fuse for Overcurrent Protection
- ATEX Fuse Overcurrent Protection (gas meter)
- TVS Diode Overvoltage Protection

## Anti-tamper:
- Reed Switches or Hall Effect Sensors

## Communication Interface:
- RF ESD Protection
- Sidactor Wired Interface Protection
- Opto-isolator Galvanic Insulation
- SSR** Pulse Output
  - Indicating Gas or Water Consumption

## Display:
- RFID Analog Front End

## Safety Valve:
- SSR** Valve Control

## Flow Measurement:
- NTC Thermistor Temperature Sensing
- Reed Switches

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** Solid State Relay
Gas and Water Meters Share Many Functional Blocks

1. Interface Panel + Prepayment Card
   - Battery with Protection
2. Wired M-Bus Pulse out Interface
   - Wireless Communication Interface
   - M-Bus, ZigBee, GSM
3. Power Management + Microcontroller
   - Temperature
   - Flow Sensor
4. Magnetic and Case Anti-tamper
5. Reed Switch
   - MDSR-10
6. Reed Switch
   - 59166, MDSM-4
7. Solid State Relay
   - LCA712
8. RFID
   - NCD1300

<table>
<thead>
<tr>
<th>Technology</th>
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<tbody>
<tr>
<td>Fuse PPTC</td>
<td>Atex 259/304, 437 Series Femto, Nano Series</td>
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<tr>
<td>TVS Diode</td>
<td>SMBJ, SMCJ</td>
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<tr>
<td>SESD Array</td>
<td>SESD0402x</td>
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<td>Opto-isolator</td>
<td>CPC130x, CPC590x</td>
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<td>Sidactor, Diode Array</td>
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<td>Solid State Relay</td>
<td>LCA182S</td>
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<td>NTC</td>
<td>MELF style, End-Banded Chip, Custom sub-assembly</td>
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<td>Reed Switch</td>
<td>MDSR-10</td>
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<td>Reed Switch</td>
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Select Standards For Electricity Meters

- IEC 62052 Series: Electricity metering equipment (AC) - General requirements, tests and test conditions
  - Part 11: Metering equipment
  - Part 31: Product safety requirements and tests
- IEC 62059 Series: Dependability of Electrical Metering Equipment
- IEC 62053 Series: Active Energy Electrical Metering Equipment – Accuracy
- Electrostatic Discharges to IEC 61000-4-2 Contact and Air Discharges
- Fast Transient Burst Test to IEC 61000-4-4
- Fast Transient Surge Test to IEC 61000-4-5 Impulse Voltage
Smart Meters Key to Advanced Energy Management

Smart Home
- Meters
- Appliances
- Thermostats
- EV Charging
- Plugs
- Smart Grid

Distributed Generation & Storage
- Renewable Energy
- EV Peak Load Shifting

Medium Voltage or Low Voltage Substations
- Data Concentrator
- Power Monitoring Unit
- Remote Terminal Unit

Smart Meters
- Residential
- Commercial
- Industrial
Littelfuse: Strategic Supplier & Design Partner

- Littelfuse provides critical functional components for smart meters
  + application expertise + guidance in product selection
- Assistance with global standards and compliance requirements
- System-level design support and testing assistance
- High-volume manufacturing with highest quality standards

Global delivery network with localized distribution & customer support